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THE CONSEQUENCE OF CHEMICAL USE ON *CERASTUS MOUSSONIANUS* HATCHABILITY

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Abstract
Cerastus moussonianus (Gastropoda: *Enidae*) Petit, 1851 is a land snail, found in gardens, cultivated field, compounds, road sides, underside the stones and woods etc. in Maharashtra. Its population reaches at high peak in the rainy season. They come out from the shell when environment is favorable (no matter whether it is day or night time) for the food and mating. *C. moussonianus* is known to cause severe damage to the plants, especially the vegetables in the fields and home gardens. Through regular field and laboratory observation, the mating behaviour viz. duration of mating, courtship behaviour, egg nesting behavior and oviposition were studied. The snails were supplied with fresh *Aloe vera* and *Brassica* leaves as food after every 24 hrs.

Keywords: *Cerastus moussonianus*, Imidacloprid, Cartap hydrochloride, hatchability etc.

Introduction

Cerastus moussonianus is a land snail, found in gardens, cultivated field, compounds, road sides and underside the stones and woods etc. in Maharashtra. Its population reaches at high peak in the rainy season. They come out from the shell when environment is favorable (no matter whether it is day or night time) for the food and mating. In unfavorable environment (e.g. when temperature rises) they move towards the dark region like soil crevices and underside of stones or wood where sun rays cannot reach withdrawing all their parts into the shell and remain in the same condition in summer.

Snail extends its body at the time of food searching, mating purpose and migration. When it extends fully measures about 1.5 to 2.0cm in length and nearly 0.75cm in width. It is broader in the middle and slightly tapers towards both the ends. Two pairs of retractable tentacles are present on the head. Anterior tentacles and posterior tentacles, anterior tentacles serves for smelling and posterior tentacles bear eyes. At the base broader part is present called foot. This secretes mucus while dwelling. The young snail exhibits the pale translucent color while it is dark in adult with light black spot of mantle cavity. Shell with six whorl coils along hollow axis known as collumella. The opening is located at the frontal basal part of the head. *Monacha obstructa* (Pfeiffer, 1842) (Hygromiidae) is the most common snail species on cultivated crops and it is recorded in high population density on egyptian clover, cabbage, green beans, maize and cucumber (Shoieb, 2008). Mollusks are ecologically important and also serve as bio-indicators and they play a fundamental role in the protection of water ecosystems by recycling nutrients and existing as food for assured aquatic animals (Giri and Wankhedkar, 2022).

C. moussonianus is known to cause severe damage to the plants, especially the vegetables in the fields and home gardens. It causes extensive damage to the crop plants in India (Magare, 1991). The biochemical effect of Cartap hydrochloride and Imidacloprid on the Albumin (ALB), Alkaline phosphatase (ALP), Glucose (GLU), Total Proteins (TP) and Uric acid (UA) with the respect to toxicity and mode of action of these pesticides in the land snail *Cerastus moussonianus* was studies by Wankhedkar and Bhavsar (2015).

Ecology, evolution and phylogeny, behaviour, and reproductive biology can all benefit from understanding life strategies. Furthermore, this knowledge is necessary for defining management methods for land snail populations on the verge of extinction, as well as pest population control (Picoral and Thome, 1989). When the links between growth, reproduction, and lifespan patterns are clarified, terrestrial mollusk life history strategies may be resolved.

Few field studies have focused on apple snail population dynamics (Burky, 1974 and Lum Kong and Kenny, 1989). The majority of the studies on the longevity of terrestrial molluscs and its relationship with life history traits involve species from temperate regions (Baur and Baur, 2000; Heller, 2001; Hommay, et al., 2001 and Ocana, 2003). Reproduction is continuous in tropical areas and the duration of the reproductive period decreases with latitude to a minimum of six months in the southern limit of its natural distribution (Martin, et al., 2001). There are a finite number of resources accessible for various biological activities. As a result, tradeoffs between life history features like reproduction, growth, and lifespan must exist. Delaying reproduction by extending the time it takes to attain sexual maturity, for example, can result in greater longevity (Zera and Harshman, 2001). International concern about the Argentinean apple snail *Pomacea canaliculata* (Lamarck, 1822) rose enormously when it became established as a serious rice pest in Asia (Estebenet and Martin, 2002).

Land snail collecting can range from a form of recreation to a serious scientific effort that leads in significant contributions to scientific knowledge. Many factors potentially influence life history traits of *P. canaliculata,* but the published information allows us to discuss only the proximal effects of some of them at the organismic level (Estebenet and Martin, 2002). The aim of this study is to analyze the information on *Cerastus moussonianus* as far as the life history is concerned on which meager work has been done by the workers.

Material and Methods

Through regular field and laboratory observation, the mating behaviour viz. duration of mating, courtship behaviour, egg nesting behavior and oviposition were studied. The snails were supplied with fresh *Aloe vera* and *Brassica* leaves as food after every 24 hrs. The unconsumed parts of the food, faecal pellets as well as the dead snails were removed regularly to maintain strict hygienic conditions. The weight and diameter of freshly laid eggs were measured with the help of an electronic balance and a centimeter scale respectively. Incubation period and hatching percentage were calculated from the emergence of juvenile snails from the eggs. The study was carried out under laboratory and natural conditions. Prevailing temperature and humidity in the laboratory were recorded. To characterize life history traits of *C. moussonianus*, we quantified for each replicate colony the pattern of survival, changes in mean animal size, the date of onset of oviposition activity and the daily reproductive output. The size of each snail was determined by measurement of shell diameter. Up to the age of 90 days shell diameters were measured at 15 day intervals. Thereafter, measurements were undertaken at 30 day intervals. The first presence of eggs in the terrarium was taken to indicate that the snails have reached sexual maturity. To record deaths, the number of oviposition events and the number and size of eggs clutches, the snails were observed daily from the first presence of eggs until death of the last individual. Growth rate was calculated as the differences in changes in shell diameter divided by number of days between the measurements. The data were expressed as mean per replicate and then averaged across the three replicates to provide parameters of life history traits applicable to groups of 30 snails. Those data were subjected to detect differences in growth of the snails during the juvenile (before the first oviposition event) and adult phases of the life cycle.

3.2.1 Collection of test animal

Adult snails of *C. moussonianus* were collected by hand picking from infested gardens, Pratap Philosophy centre, roadside area and college premices of Amalner Taluka during the rainy and winter season.

3.2.2 Preparation of terrarium

Archer (1937) gave detailed instructions for converting an aquarium or a flowerpot into a snail terrarium. Carmichael (1937) presented methods for rearing slugs, including handling instructions for their eggs and juveniles. Krull (1937) gave directions for establishing a terrarium suitable for large species, such as

Mesodon thyroidus. Sturm, et al. (2006) gave detailed information about rearing terrestrial gastropod. Grimm (1974) addressed and proposed solutions to the different challenges that snail raisers face. The obtained snails were transferred in terrarium (60×30×30cm) which is covered by sponge internally to maintain humidity and surface is covered by metal wire net for ventilation. The terrarium is filled with moist sterilized sandy loamy soil ½:1 (w:v) and fed on fresh leaves of *Aloe vera*, boiled egg pieces, chalk dust, cabbage and lettuce etc. for 14 days to be laboratory acclimatized (photoperiod 14L: 10D; temperature 27-32°C; relative humidity 90% from June to Sept.).

3.4.1 Food

Shoaib, et al. (2010) used the fresh cabbage leaves as a food for *Monacha obstructa*. Omole, et al. (2011) provided the pineapple waste to *Archachatina marginata* as a food.

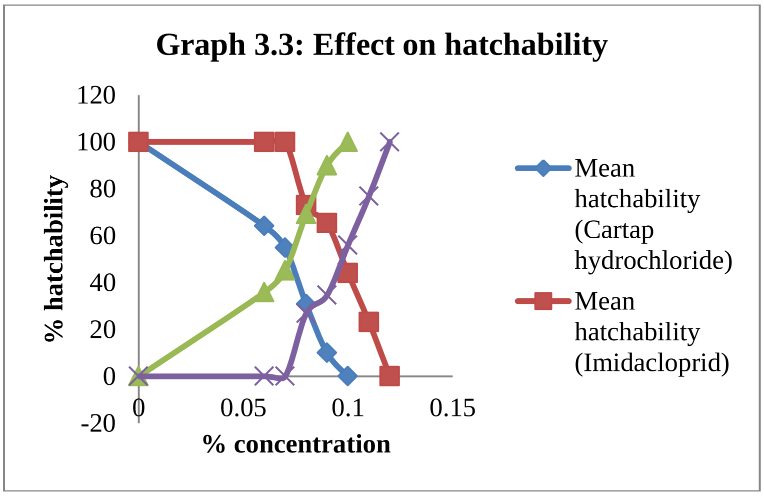
In present study *Aloe vera* was offered to the snail and during the experiment and in culture medium chalk dust, lettuce, boiled egg pieces, etc. are offered along with. The snails were treated with food diet Cartap hydrochloride concentration 0.06, 0.07, 0.08, 0.09 and 0.10% respectively and with Imidacloprid concentration 0.08, 0.09, 0.10, 0.11 and 0.12% respectively found in the previous research of Wankhedkar, et. al. (2011).

Result and Discussion

The effect on the hatchability was encountered in the eggs laid during the Treatment and % was calculated in mean±SE. Eggs hatched after 4-6 days of laying. In comparison with control 100% hatchability treated with Cartap hydrochloride, the hatchability was decreased in the snail by 35.8, 45.2, 69.2, 90 and 100% as per the concentration increases 0.06, 0.07, 0.08, 0.09 and 0.10% respectively and with Imidacloprid the food consumption was decreased in the snail by 26.8, 34.6, 56, 76.8 and 100% as per the concentration increases 0.08, 0.09, 0.10, 0.11 and 0.12% respectively (Graph 3.3) (Table 3.2).

Food treated with	Concentrations (In %)	Mean hatchability in %	Decrease in mean hatchability in %
	Control	100	00
Cartap hydrochloride	0.06	64.2±1.01	35.8
	0.07	54.8±0.96	45.2
	0.08	30.8±1.06	69.2
	0.09	10±0.70	90
	0.10	00	100
Imidacloprid	0.08	73.2±1.01	26.8
	0.09	65.4±1.28	34.6
	0.10	44±0.70	56
	0.11	23.2±0.66	76.8
	0.12	00	100

Table 3.2: Effect on hatchability



Prakash Tanaji Wankhedkar, Niranjan Ramesh Giri, Shaikh Hasim Mohammed Isak

Saha and Roy (1994) stated that incubation period of eggs in *M. tugurium* ranged from 18.4 days to 22.17 days and percentages of eggs hatched were 97.10% and 99.91% under laboratory conditions (16.0-21.5ºC). From the result, it is evident that the incubation periods were 14.0 to 18.4 days and percentage of eggs hatched were 94.44% to 98.66% under laboratory conditions (21.44 – 29.18ºC) for *M. sequax*. Shoaib, et al., 2010 observed the effect of Nimbecidine® on the hatchability of *M. obstructa* and found that the eggs treated with highest concentration of Nimbecidine® (10 ml/l) caused 100% mortality of eggs. The mean egg production was between 20 and 50 percent at lower concentrations, based on the concentration level. Mean values of Nimbecidine® lethal concentrations LC_{20}, LC_{50} and LC_{90} for the eggs were 0.80 (0.50–1.28; 95% confidence interval) ml/l, 2.18 (1.71–2.78) ml/l and 10 (6.88–14.52) ml/l, respectively.

In present study the 100% mortality was recorded at 0.10% of Cartap hydrochloride and 0.12% of Imidacloprid which is matches with the result of Saha and Roy, 1994 and Shoaib, et al., 2010

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